

Working towards a Meaningful Transition of Human Control over Automated Driving Systems

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Working Towards a Meaningful Transition of Human Control over Automated Driving Systems

MHC-ADS



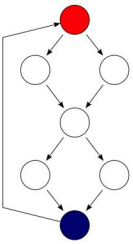
The Questions

What do we know about human behaviour in automated driving?
 What Human Factors play a role during automated driving?
 What role do they play during a transition of control?
 Which skills, rules, and knowledge are involved?
 Can we go from a technical perspective to a human-oriented perspective?



The Aim

Develop a framework of human control over automated driving systems.
 Take a quantitative approach.
 Use literature on skills, rules, and knowledge with automated driving.
 Take a novice driver just granted their license as a baseline.
 Maintain a EU-wide perspective.



The Process

Step 1: SAE Levels of Automation - the starting point.
 - No Automation (level 0) to Full Automation (level 5).
 Step 2: Classification of human behaviour (Rasmussen, 1983).
 - Skill-, rule-, & knowledge-based behaviour.
 Step 3: Human behaviour at level 0 - the baseline.
 - Skills, rules & knowledge during manual driving set by EU.
 Step 4: The Levels of Automation (level 1-3).
 - Little literature; use of known ADAS & advanced training courses.
 Step 5: The unknown - beyond human fall-back (level 4-5).
 - Non-existent, open for debate and imagination.



The Results

Automation	SAE 0	SAE 1	SAE 2	SAE 3	SAE 4	SAE 5
Human	No Automation	Driver Assistance	Partial Automation	Conditional Automation	High Automation	Full Automation
Skill	128 ¹	127 - 114	114	114 - 43	40 - 0?	39 - 0?
Rule	254 ²	255 - 250	250	250 - 69* - 66	51 - 29?	29 - 0?
Knowledge	65 ³	65 - 81	81	81 - 34?!	0 - ?!	0?

¹ = Harmonisation of the Assessment of Driving Test Candidates (CIECA RSC working group, 2006)
² = Convention on road traffic (United Nations, 1968; 2014)
³ = Various advanced driver training courses (a.o.)
 * = In case of accident; i.e., when automation is not capable of avoiding an accident
 ? = Unknown situations at higher levels of automation
 ! = Driver skill-/rule-based behaviour may deteriorate to knowledge-based
 | = Fall-back to human up to level 3 -> human needs at times adhere to level 0



The Implications

The decline in skill- and rule-based behaviour
 The rise and fall of knowledge-based behaviour
 The human driver as a fall-back mechanism
 SAE level 4 and 5 automation: the path of the unknown



The "Now What?"

Mismatch between supply and demand!
 Human-oriented taxonomy.
 Empirical testing.
 Qualitative approach?